Photodeflection Method of Investigation of the Thermophysical Properties of Heterogeneous Media with Use of Laser Bessel Beams

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One of the main and important long-range directions of the development of modern systems of diagnostics and nondestructive control is working out ways of noncontact, remote detection of mechanical strengths and defects in condensed media. A series of methods is used for the solution of these complex problems, among which it is necessary to single out ultrasound spectroscopy, methods of holographic interferometry and diffraction methods. Photothermal methods of investigation of condensed media have been widely used recently. The present paper is devoted to the investigation of thermophysical properties of spatially heterogeneous media by the photodeflection spectroscopy method using laser Bessel beams. The presence of the specific qualities, in particular, the absence of diffraction during their propagation, self-effect, explains the use of Bessel light beams. This opens potential applications in such spheres as nanotechnology, biophysics and nonlinear optics.

In the framework of the laser photodeflection spectroscopy method, the system of heat conduction equations, describing temperature distribution in a layered heterogeneous medium, have been solved. The quantitative evaluations of the value of photodeflection signal amplitude in spatially heterogeneous sample have been performed numerically. The main peculiarities of the photodeflection response formation were found.

Comparison analysis of the efficiency of the photodeflection response formation during the excitation of the condensed heterogeneous medium by plane light waves and Bessel light beams have been carried out. The application of Bessel light beams is more useful in comparison with plane light waves in a series of specific cases.